

Part 2 – Amendment to the Claims

1. (Presently Amended) A recirculation system for retaining substantial thermal energy content of air drawn from within a confined environment as part of an exhaust flow which includes gaseous contaminants, the gaseous contaminants of the exhaust flow including carbon monoxide gas, comprising:

5 a collector device located within the confined environment to receive and establish the exhaust flow of contaminants and air from within the confined environment;

a cleaner device connected to receive the exhaust flow from the ~~exhaust~~ collector device;

10 the cleaner device comprising a scrubber module, a liquid removal module and a filtering and conversion module connected in series through which the exhaust flow passes;

the scrubber module including flow passageways through which the exhaust flow passes and into which cleaning liquid is distributed for mixture with and entrainment of contaminants of the exhaust flow;

15 the liquid removal module removing cleaning liquid from the flow from the scrubber module;

the filtering and conversion module comprising an odor-removing filter and a catalyst;

20 the odor-removing filter removing odor from the flow from the liquid removal module;

the catalyst operating at room temperature to facilitate ~~facilitating~~ conversion of the carbon monoxide gaseous contaminants ~~gas~~ in the flow from the liquid removal module into benign carbon dioxide gaseous constituents; and

25 a delivery device located within the confined environment to receive the flow from the cleaner device and discharge the flow into the confined environment.

2. (Currently Amended) A recirculation system as defined in claim 1 wherein the confined environment is a food preparation establishment having an

open flame cooker which produces the carbon monoxide gas, odor, smoke and airborne grease as particulate and gaseous cooking exhaust contaminants, and

5 wherein:

the collection device comprises an exhaust collection hood located over the open flame cooker;

the scrubber module ~~remove~~ removes substantially all of the particulate contaminants from the exhaust flow; and

10 the ~~[[a]]~~ catalyst facilitates conversion of the carbon monoxide gas in the flow from the liquid removal module into the carbon dioxide gas.

3. (Original) A recirculation system as defined in claim 2 wherein:
the delivery device discharges the flow from the filtering and conversion module into the exhaust hood.

4. (Canceled)

5. (Currently Amended) A recirculation system as defined in claim 1 ~~[[4]]~~ wherein:

the catalyst utilizes air from the exhaust flow and carbon monoxide from the flow to facilitate formation of the ~~form~~ carbon dioxide.

6. (Currently Amended) A recirculation system as defined in claim 1 ~~[[4]]~~ wherein:

the catalyst comprises mixed manganese copper oxide.

7. (Canceled)

8. (Currently Amended) A recirculation system as defined in claim 1 ~~[[4]]~~ wherein the contaminants from the exhaust flow include odor, and wherein:
the filter comprises a carbon particle filter.

9. (Currently Amended) A recirculation system as defined in claim 1 ~~[[4]]~~ further comprising:

a heater positioned to heat the catalyst to a predetermined temperature sufficient to regenerate catalytic characteristics of the catalyst.

10. (Currently Amended) A recirculation system as defined in claim 1 ~~[[4]]~~ wherein the filtering and conversion module includes a catalyst cell ~~through~~

~~which the flow from the liquid removal module passes, the catalyst cell comprising:~~

a layer of particles of the room-temperature catalyst; and

5 a layer of carbon particles.

11. (Original) A recirculation system as defined in claim 10 wherein the catalyst cell further comprises:

a heater positioned within the layer of catalyst particles to heat the catalyst particles to a predetermined temperature sufficient to regenerate catalytic
5 characteristics of the catalyst.

12. (Currently Amended) A recirculation system as defined in claim 1 ~~[[4]]~~ wherein the filtering and conversion module further comprises:

a filter device connected to receive the flow from the liquid removal device, the filter device comprising one of a HEPA, DOP or BAG filter.

13. (Currently Amended) A recirculation system as defined in claim 1 wherein the scrubber module further comprises:

a baffle-defining structure comprising a plurality of vertically spaced and interdigitated deflection plates which define a serpentine-shaped flow
5 passageway through which the exhaust flow moves generally upward; and

a liquid distributor positioned within the ~~each~~ passageway of the baffle-defining structure to flow liquid cleaning agent downward through the ~~each~~ passageway and generally onto the deflection plates;

the baffle-defining structure further comprising a plurality of vertically
10 spaced deflection plates extending generally horizontally in the passageway, each deflection plate having a main portion sloping downward and an outer end lip portion extending from the main portion, vertically adjacent and consecutive deflection plates in the passageway extending in opposite directions with respect to one another, the vertically spaced deflection plates interdigitating with one
15 another, and the lip portions horizontally overlapping the main portion of at least one vertically adjacent deflection plate to form the passageway in a serpentine manner having repeated alternating-direction turns around the lip portions of the deflection plates; and

the liquid flows off the lip portion of each deflection plate into and
20 through the exhaust flow turning around the lip portion to mix the exhaust flow and
the liquid to entrain the contaminants in the liquid.

14. (Original) A recirculation system as defined in claim 13 wherein:
the vertically adjacent deflection plates overlap one another within the
range of approximately 51% to 80% of the horizontal extent of each deflection
plate.

15. (Original) A recirculation system as defined in claim 13 wherein:
the angle of each lip portion relative to the flow around each lip
portion causes at least a portion of the liquid flowing from the lip portion of the
deflection plate to be driven upward from the lip portion with the flow and mixed
5 with the flow.

16. (Original) A recirculation system as defined in claim 13 wherein:
the main portion of the immediately below-positioned deflection plate
and the immediately above-positioned deflection plate define a flow/liquid mixing
zone in the passageway between vertically adjacent deflection plates;
5 the angle of each lip portion relative to the flow around each lip
portion causes at least a portion of the liquid flowing from the lip portion of the
deflection plate to be driven upward from the lip portion with the flow and mixed
with the flow in the mixing zone; and

the lip portion of each deflection plate extends into the flow to create
10 a vortex motion of the flow in the mixing zone to increase the contact of the
contaminants in the flow with the liquid.

17. (Currently Amended) A recirculation system as defined in claim 13
wherein the scrubber module ~~further comprises~~ further comprises:
a liquid removal device connected to receive the flow from the baffle-
defining structure, the flow from the baffle-defining structure containing a mist of
5 the liquid, the liquid removal device removing a substantial majority of the liquid
mist from the flow before passing into the liquid removal module.

18. (Original) A recirculation system as defined in claim 17 wherein the

liquid removal device comprises a cyclone.

19. (Original) A recirculation system as defined in claim 1 wherein the liquid removal device comprises:

5 a curved sidewall structure along which the flow from the scrubber module moves in a curved motion to force liquid in the flow from the scrubber module to coalesce into liquid and drain along the sidewall structure.

20. (Currently Amended) A recirculation system as defined in claim 19 wherein the curved sidewall structure also forces the contaminants in the flow ~~are also forced~~ against the sidewall structure to become entrained in the liquid on the sidewall structure.

21. (Original) A recirculation system as defined in claim 19 further comprising a demisting wall positioned in the flow between the scrubber module and the liquid removal module to remove a part of the liquid mist in the flow from the scrubber module.

22. (Currently Amended) A recirculation system for retaining substantial thermal energy content of air drawn from within a confined environment as part of an exhaust flow which includes gaseous contaminants, the contaminants of the exhaust flow including carbon monoxide gas, comprising:

5 a collector device located within the confined environment to receive and establish the exhaust flow of contaminants and air from within the confined environment;

10 a scrubber module comprising a passageway through which the exhaust flow from the delivery device moves in one direction and a liquid cleaning agent moves in an opposite direction by which to entrain contaminants from the exhaust flow within the liquid;

15 a liquid removal module comprising a curved sidewall structure along which the flow from the scrubber module moves in a curved motion to force liquid in the flow to coalesce on the sidewall structure and to force contaminants in the flow against the sidewall structure to become entrained in the liquid on the sidewall structure;

a filtering and conversion module comprising an odor-removing filter and a catalyst;

the odor-removing filter removing odor from the flow from the liquid removal module;

the catalyst operating at room temperature to facilitate ~~facilitating~~ conversion of the carbon monoxide gaseous contaminants in the flow from the liquid removal module into benign carbon dioxide gaseous constituents; and

a delivery device located within the confined environment to receive the flow from the cleaner device and discharge the flow into the confined environment.

23. (New) A recirculation system for retaining substantial thermal energy content of air drawn from within a confined environment as part of an exhaust flow which includes gaseous contaminants, comprising:

a collector device located within the confined environment to receive and establish the exhaust flow of contaminants and air from within the confined environment;

a cleaner device connected to receive the exhaust flow from the collector device;

the cleaner device comprising a scrubber module, a liquid removal module and a filtering and conversion module connected in series through which the exhaust flow passes;

the scrubber module including flow passageways through which the exhaust flow passes and into which cleaning liquid is distributed for mixture with and entrainment of contaminants of the exhaust flow, wherein the scrubber module further comprises:

a baffle-defining structure comprising a plurality of vertically spaced and interdigitated deflection plates which define a serpentine-shaped flow passageway through which the exhaust flow moves generally upward; and

a liquid distributor positioned within the passageway of the baffle-defining structure to flow liquid cleaning agent downward through the passageway

and generally onto the deflection plates;

25 the baffle-defining structure further comprising a plurality of vertically spaced deflection plates extending generally horizontally in the passageway, each deflection plate having a main portion sloping downward and an outer end lip portion extending from the main portion, vertically adjacent and consecutive deflection plates in the passageway extending in opposite directions with respect to one another, the vertically spaced deflection plates interdigitating with one another, and the lip portions horizontally overlapping the main portion of at least one vertically adjacent deflection plate to form the passageway in a serpentine manner having repeated alternating-direction turns around the lip portions of the deflection plates;

30 the liquid flows off the lip portion of each deflection plate into and through the exhaust flow turning around the lip portion to mix the exhaust flow and the liquid to entrain the contaminants in the liquid;

35 the liquid removal module removing cleaning liquid from the flow from the scrubber module;

 the filtering and conversion module comprising an odor-removing filter and a catalyst;

40 the odor-removing filter removing odor from the flow from the liquid removal module;

 the catalyst facilitating conversion of the gaseous contaminants gas in the flow from the liquid removal module into benign gaseous constituents; and

45 a delivery device located within the confined environment to receive the flow from the cleaner device and discharge the flow into the confined environment.

24. (New) A recirculation system as defined in claim 23 wherein:

 the vertically adjacent deflection plates overlap one another within the range of approximately 51% to 80% of the horizontal extent of each deflection plate.

25. (New) A recirculation system as defined in claim 23 wherein:

the angle of each lip portion relative to the flow around each lip portion causes at least a portion of the liquid flowing from the lip portion of the deflection plate to be driven upward from the lip portion with the flow and mixed with the flow.

26. (New) A recirculation system as defined in claim 23 wherein:
the main portion of the immediately below-positioned deflection plate and the immediately above-positioned deflection plate define a flow/liquid mixing zone in the passageway between vertically adjacent deflection plates;
the angle of each lip portion relative to the flow around each lip portion causes at least a portion of the liquid flowing from the lip portion of the deflection plate to be driven upward from the lip portion with the flow and mixed with the flow in the mixing zone; and
the lip portion of each deflection plate extends into the flow to create a vortex motion of the flow in the mixing zone to increase the contact of the contaminants in the flow with the liquid.

27. (New) A recirculation system as defined in claim 23 wherein the scrubber module further comprises:
a liquid removal device connected to receive the flow from the baffle-defining structure, the flow from the baffle-defining structure containing a mist of the liquid, the liquid removal device removing a substantial majority of the liquid mist from the flow before passing into the liquid removal module.

28. (New) A recirculation system as defined in claim 27 wherein the liquid removal device comprises a cyclone.

29. (New) A recirculation system as defined in claim 23 wherein the liquid removal device comprises:

a curved sidewall structure along which the flow from the scrubber module moves in a curved motion to force liquid in the flow from the scrubber module to coalesce into liquid and drain along the sidewall structure.

30. (New) A recirculation system as defined in claim 29 wherein the curved sidewall structure also forces the contaminants in the flow against the

sidewall structure to become entrained in the liquid on the sidewall structure.

31. (New) A recirculation system as defined in claim 29 further comprising a demisting wall positioned in the flow between the scrubber module and the liquid removal module to remove a part of the liquid mist in the flow from the scrubber module.

32. (New) A recirculation system as defined in claim 23 wherein the confined environment is a food preparation establishment having an open flame cooker which produces the carbon monoxide gas, odor, smoke and airborne grease as particulate and gaseous cooking exhaust contaminants, and wherein:

5 the collection device comprises an exhaust collection hood located over the open flame cooker;

 the scrubber module removes substantially all of the particulate contaminants from the exhaust flow; and

10 the catalyst facilitates conversion of the carbon monoxide gas in the flow from the liquid removal module into the carbon dioxide gas.

33. (New) A recirculation system as defined in claim 32 wherein:
 the delivery device discharges the flow from the filtering and conversion module into the exhaust hood.

34. (New) A recirculation system as defined in claim 23 wherein:
 the catalyst utilizes air from the exhaust flow and carbon monoxide from the flow to facilitate formation of the carbon dioxide.

35. (New) A recirculation system as defined in claim 23 wherein:
 the catalyst comprises mixed manganese copper oxide.

36. (New) A recirculation system as defined in claim 23 wherein the contaminants from the exhaust flow include odor, and wherein:
 the filter comprises a carbon particle filter.

37. (New) A recirculation system as defined in claim 23 further comprising:
 a heater positioned to heat the catalyst to a predetermined temperature sufficient to regenerate catalytic characteristics of the catalyst.

38. (New) A recirculation system as defined in claim 23 wherein the filtering and conversion module includes a catalyst cell comprising:

- a layer of particles of the room-temperature catalyst; and
- a layer of carbon particles.

39. (New) A recirculation system as defined in claim 10 wherein the catalyst cell further comprises:

- a heater positioned within the layer of catalyst particles to heat the catalyst particles to a predetermined temperature sufficient to regenerate catalytic characteristics of the catalyst.

5

40. (New) A recirculation system as defined in claim 23 wherein the filtering and conversion module further comprises:

- a filter device connected to receive the flow from the liquid removal device, the filter device comprising one of a HEPA, DOP or BAG filter.